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**PREDICTION AND GEOGRAPHICAL INFORMATION SYSTEM (GIS)
MAPPING OF GROUND MOTIONS AND SITE RESPONSE IN CHARLESTON,
SC AND TWO NEIGHBORING COUNTIES: FIRST PHASE DEVELOPMENT
OF A GIS FOR SEISMIC HAZARD EVALUATION**

Final Report, June 12, 2003

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TECHNICAL ABSTRACT

This study estimates the response of near-surface geologic units in the Charleston area to strong ground motion, and produces results in a GIS coverage. The study area is approximately 1650 km² in extent, and includes portions of Charleston, Dorchester and Berkeley counties, south of latitude 33.0N latitude and between 80.25W and 79.75W longitude. The main area of interest is within a 20 km radius of the city of Charleston. Geologic mapping by the U.S. Geological Survey is used to characterize the geologic units of the area. The data used for dynamic site response analysis consists of 281 standard penetration tests and cone penetrometer tests. Direct shear wave velocity measurements at 52 locations from seismic cone penetrometer tests are included. Regression models are developed for shear wave velocity as a function of cone penetrometer tip resistance, effective overburden pressure and lithology. Site specific response is quantified using non-linear dynamic analysis in terms of the ratio of soil surface motion to hypothetical hard rock (pre-Cretaceous) basement outcrop motion. Absolute acceleration response ratios for 5% oscillator damping are computed for 12 oscillator frequencies ranging from 0.1 to 30 Hz and for peak ground acceleration. Scenario earthquake basement motions were developed using the stochastic model. The results of the dynamic analysis are examined for correlation and dependence upon mapped geology and shallow geologic structure. The input data and results are cast as a geographic information system coverage using the ArcGIS software application available from Environmental Systems Research Institute, Inc., Redlands, California.

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NON -TECHNICAL SUMMARY

This study estimates the response of near-surface geologic units in the Charleston area to strong ground motion, and produces results in a GIS coverage. The study area is approximately 1650 km² in extent, and includes portions of Charleston, Dorchester and Berkeley counties, south of latitude 33.0N latitude and between 80.25W and 79.75W longitude. The main area of interest is within a 20 km radius of the city of Charleston. Geologic mapping by the U.S. Geological Survey is used to characterize the geologic units of the area. Calculations are performed using data from 281 geotechnical investigations to predict site response to earthquake shaking. The predictions are made using six different scenario earthquakes, with peak accelerations ranging from 0.1 to 0.6 g. The results of the dynamic analysis are examined for correlation and dependence upon mapped geology and shallow geologic structure. To facilitate the use of the results by the scientific, engineering and land-use planning communities, the products of the research are incorporated into a geographical information system coverage using the ArcGIS software application available from Environmental Systems Research Institute, Inc., Redlands, California.